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10/805,811	03/22/2004	Kevin T. Marks	016295.1576	1073
7590		01/29/2008		
Roger Fulghum				
Baker Botts L.L.P.				
One Shell Plaza				
910 Louisiana Street				
Houston, TX 77002-4995				
			EXAMINER	
			WALTER, CRAIG E	
			ART UNIT	PAPER NUMBER
			2188	
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			01/29/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/805,811

Applicant(s)

MARKS ET AL.

Examiner

Craig E. Walter

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 17 December 2007.
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,2,4-6,9-12,14 and 16-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,2,4-6,9-12,14 and 16-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☐ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date 8/28/07.
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- ☐ Notice of Informal Patent Application
- ☐ Other: _____.

DETAILED ACTION

Status of Claims

1. Claims 1, 2, 4-6, 9-12, 14 and 16-20 are pending in the Application.

Claims 3, 7, 8, 13 and 15 are cancelled.

Claims 1, 5, 6, 10, 12, 14, 16 and 18 are amended.

Claims 1, 2, 4-6, 9-12, 14 and 16-20 are rejected.

Response to Amendment

2. Applicant's amendments and arguments filed on 17 December 2007 in response to the Office action mailed on 17 August 2007 have been considered but they are not persuasive. Therefore, the rejections made in the previous office action are maintained, and restated below, with changes as needed to address the amendments.

Information Disclosure Statement

3. The information disclosure statement filed 28 August 2007 fails to comply with the provisions of 37 CFR 1.97, 1.98 and MPEP § 609 because documents J, K (nor their concise English summaries), and M-Q are not present in the file wrapper. It has been placed in the application file, but the information referred to therein has not been considered as to the merits. Applicant is advised that the date of any re-submission of any item of information contained in this information disclosure statement or the submission of any missing element(s) will be the date of submission for purposes of determining compliance with the requirements based on the time of filing the statement,

including all certification requirements for statements under 37 CFR 1.97(e). See MPEP § 609.05(a).

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. Claims 1, 2, 4, 10-12, 14 and 16-20 are rejected under 35 U.S.C. 102(e) as being anticipated by Horst et al. (US Patent 6,567,892 B1), hereinafter Horst.

As for claim 1, Horst teaches a method for managing rebuild commands directed from a drive controller to a drive (Fig. 1, element 110), the drive having a first non-volatile memory and a cache (Fig. 1, element 132), the drive controller having a non-volatile second memory (Fig. 1, elements 126, 128, 180);

enabling the cache of the drive (col. 7, lines 35-52 – the cache is enabled);

recording in the second memory of the drive controller each rebuild command directed to the drive (the pending completion write queue (Fig. 1, element 170) is used to queue pending commands from the device driver – column 7, lines 35-45); and

periodically causing the drive to flush its cache to cause data cached in the cache of the drive and associated with the rebuild commands to be transmitted to the first non-volatile memory of the drive (col. 7, lines 35-42 – the write cache is periodically flushed to the drive), comprising the steps of:

maintaining a count in the drive controller of the number of commands stored in the second memory of the drive controller (the device driver queue tracks the number of commands queued in the pending completion write queue – col. 7, lines 35-67), and

causing the drive to flush its cache when the count of the number of commands stored in the second memory of the drive controller reaches a predetermined threshold wherein each rebuild command directed to drive is at least temporarily recorded in the second memory during the period that the cache of the drive is enabled (the write cache is enabled to improve write performance, and subsequently flushed when the host runs out of commands (i.e. the maximum queue depth is achieved (i.e.256) – col. 7, lines 35-67)).

As for claim 10, Horst teaches a method for rebuilding storage media of a drive, wherein the drive is in communication with a drive controller and a write cache that may be selectively enabled, the method comprising:

enabling the write cache for the drive (col. 7, lines 35-52 – the cache is enabled);

transmitting one or more commands to the drive from the drive controller (the host (Fig. 1, element 102) sends commands to the array controller (Fig. 1, element 100) – col. 5, lines 25-47);

writing the one or more commands to a journal located in the drive controller (the pending completion write queue (Fig. 1, element 170) is used to queue pending commands from the device driver – column 7, lines 35-45);

providing a count of commands sent to the drive, wherein the count is located in the drive controller (commands from the host are queued in the pending completion write queue (i.e. the number of commands stored = the count of commands sent from the host – col. 7 35-67));

forcing the drive to flush the data in the write cache to the storage media (the write cache is flushed to the drives – col. 7, lines 35-52); and

wherein the step of forcing the drive to flush data in the write cache is performed once the count of commands sent to the drive reaches a predetermined value (the write cache is enabled to improve write performance, and subsequently flushed when the host runs out of commands (i.e. the maximum queue depth is achieved (i.e.256) – col. 7, lines 35-67)).

As for claim 18, Horst teaches a drive controller operable to communicate with a drive through a communications channel, comprising:

a first memory for recording commands transmitted from the drive controller to the drive during a period that the drive is being rebuilt (the first memory is depicted in Fig. 1, elements 126, 128 and 180, the pending completion write queue (Fig. 1, element 170) is used to queue pending commands from the device driver – column 7, lines 35-45);

a second memory for storing a count of the commands recorded in the first memory (the device driver's queue functions as a counter by issuing commands to the pending completion write queue until it reaches its maximum depth (i.e. 256) - col. 7, lines 35-67);

wherein, during the period that the drive is being rebuilt, the drive controller is operable to enable the write cache of the drive and cause the drive to flush the data in a write cache of the drive when the count of the commands reaches a predetermined threshold (the write cache is enabled to improve write performance, and subsequently flushed when the host runs out of commands (i.e. the maximum queue depth is achieved (i.e.256) – col. 7, lines 35-67).

As for claims 11 and 14, Horst teaches the drive controller as being operable to clear its first memory following the indication of the successful flushing of data in the write cache of the associated drive (the pending complete write queue is cleared once flush is complete – col. 7, lines 35-53).

As for claims 2 and 12, Horst teaches disabling the write cache of the drive following the successful rebuild of the drive (the write cache is enabled to queue

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commands prior to the flush operation - col. 7, lines 35-52; the cache is therefore disabled upon the completion of a successful rebuild of the drive once the flush is complete)).

As for claim 4, Horst teaches clearing the second memory and the count following the successful flushing of the cache to the first non-volatile memory (col. 7, lines 35-42 – the data is flushed to the cache)

As for claim 16, Horst teaches clearing the journal after the drive flushes all data in the write cache and transmits a message indicating that the cached data was written to the storage media (col. 7, lines 35-67 – the host receives the completion interrupts after the cache was flushed to indicate the data has been flushed, therefore the journal may be cleared)

As for claim 17, Horst teaches the journal as being comprised of non-volatile memory (Fig. 1, elements 126, 128 and 180 comprise non-volatile memory).

As for claim 19, Horst teaches the drive controller as being operable to disable the write cache of the drive following the successful rebuild of the drive (the write cache is enabled to queue commands prior to the flush operation - col. 7, lines 35-52; in other words, it is operable to disable the cache upon the completion of a successful rebuild of the drive once the flush is complete).

As for claim 20, Horst teaches the first memory as comprising a non-volatile memory (the first memory (Fig. 1, element 126, 128, 180) comprises ROM memory for example (Fig. 1, element 126)).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 5, 6 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Horst (US Patent 6,567,892 B1) and in further view of Wu et al. (US PG Publication 2004/0117579 A1), hereinafter Wu.

As for claim 5, Horst teaches a storage array, comprising:

multiple drives (Fig. 1, elements 110),

a write cache for caching data associated with write commands received by the drive (Fig. 1, element 132); and

drive controller (Fig. 1, element 120), wherein the drive controller is associated with and coupled to a drive of the storage array, wherein the drive controller comprises a first memory ((Fig. 1, elements 126, 128 and 180), wherein the first memory is operable to store a history of write commands transmitted from each drive controller to its associated drive (the pending completion write queue (Fig. 1, element 170) is used to queue pending commands from the device driver – column 7, lines 35-45)); and

wherein each drive controller is operable to manage the rebuild of its associated drive by:

enabling the write cache for the drive (col. 7, lines 35-52 – the cache is enabled);

recording each write command sent to the drive in the first memory (the pending completion write queue (Fig. 1, element 170) is used to queue pending commands from the device driver – column 7, lines 35-45); periodically causing the drive to flush the data in the write cache of the drive (data is flushed to the drive - col. 7, lines 35-67); and disabling the write cache for the drive upon the successful completion of the rebuild of the drive (the write cache is enabled to queue commands prior to the flush operation. The cache is disabled once the flush occurs - col. 7, lines 35-52);

a second memory for recording the number of commands stored in the first memory (the device driver queue tracks the number of commands queued in the pending completion write queue – col. 7, lines 35-67), and wherein each drive controller is operable to cause its associated drive to flush the data in the write cache when the number of commands stored in the first memory reaches a predetermined threshold (the write cache is flushed when the host runs out of commands (i.e. the maximum queue depth is achieved (i.e.256) – col. 7, lines 35-67)).

Despite these teachings, Horst fails to teach each drive as comprising a write cache (rather Horst teaches only one write cache in the array controller), and each drive controller as comprising a first memory (rather Horst teaches his one array controller as

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comprising a first memory). Horst further fails to teach each drive controller as comprising a second memory. Horst however does teach an embodiment where a single disk drive and controller unit can be used in place of the array controller (i.e. all the structural elements of the array controller as presently depicted in Fig. 1 are contained within a single disk controller which is solely responsible for serving one disk drive – col. 5, lines 12-24). Despite these teachings, Horst fails to teach multiple controllers; wherein each controller is associated with a drive as presently recited by Applicant.

Wu however teaches system and method for implementing shared memory regions in distributed shared memory systems, wherein each drive controller (Fig. 1, elements 14A and 14B), is associated with a single drive (Fig. 1, elements 16A and 16B) – paragraph 0032, all lines.

It would have been obvious to one of ordinary skill in the art at the time of the invention for Horst to further include Wu's system for implementing shared memory regions in distributed shared memory systems. By doing so, Horst would be able to exploit the benefits of cache mirroring and write cache coherency; which in turn would improve his system's overall reliability as taught by Wu in paragraphs 0007 and 0008, all lines.

As for claim 6 Horst teaches the drive controller as being operable to clear its first memory following the indication of the successful flushing of the data in the write cache of the associated drive (the pending complete write queue is cleared once flush is complete – col. 7, lines 35-53).

As for claim 9, Horst teaches the first memory as being non-volatile (Fig. 1, elements 126, 128 and 180 comprise non-volatile memory).

Response to Arguments

7. Applicant's argument with respect to claims 1, 2, 4-6, 9-12, 14 and 16-20 have been fully considered, however they are not persuasive.

As for claims 1, 10 and 18, Applicant asserts, "Horst fails to teach providing a count of commands, stored in each drive controller. At best, Horst teaches that a maximum queue depth (of 256 for example) may be reached, and this situation may be detected by a timer that is configured to fire at an expected maximum amount of time between commands. (Horst, col. 7, lines 65-67) First, Horst fails to teach a command count that is maintained in a drive controller. The queue in Horst that has a maximum depth is located outside of the drive controllers. (Horst, Figure 1) Horst teaches a timer (and not a count) that is set to fire at a certain time, and this timer is not stored in a drive controller, or in each drive controller. (Horst, col. 7, lines 65-67)."

This argument however is not persuasive for several reasons.

First, it is clear from this argument that Applicant misconstrued Examiner's application of the Horst reference. More specifically (by referring to Fig. 1), Examiner clearly mapped the array controller (element 120) to the drive controller as recited in the instant claims (see for example lines 1 and 2 of page 5 of the Office action made non-final mailed 17 August 2007). This example clearly illustrates Examiner's interpretation that Horst's drive controller includes elements 126, 128 and 180 (all being included in

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element 120). It appears Applicant is arguing that drive controller (122 for example) does not include a count of the number of commands. This assertion however is rendered moot, as Examiner never mapped element 122 to Applicant's drive controller recited in the instant claims. Further support for this contention is shown where Examiner clearly mapped element 120 of Fig. 1 of Horst to Applicant's recited drive controller as per the rejection of claim 5 (see Office action made non-final, mailed 17 August 2007 – page 10, line 1).

Secondly, Applicant's argument that keeping a command count is not the same as having a timer that goes off at an expected time is rendered moot, as this argument perverts the thrust of Examiner's rejection. Applicant cites a very limited subsection of Horst's disclosure relied upon by Examiner in the Office action, and attempts to contrast it with limitations recited in the instant claims. Examiner however directs Applicant's attention to col. 7, lines 35-67 (which was originally cited to read on maintaining a count of commands) of Horst. These lines clearly demonstrate commands being stored in a pending completion write queue. This queue allows the system to collect and coalesce commands so that the system may maintain critical aspects of the commands (the queue stores the commands themselves, the order in which they are received (inherently the function of a queue), and the number that are presently stored (number of entries in the queue equals the running count before they are flushed)) until they are needed (i.e. number of commands the host has to give runs out).

As for claim 5, Applicant sets forth an argument alleging that Horst in view of Wu fail to render the claim obvious, because Wu fails to cure the alleged deficiencies of Horst (as specified by Applicant in the arguments set forth for claims 1, 10 and 18).

This argument however is not persuasive, as Examiner maintains Horst does in fact teach the elements of claim 5 in common with claims 1, 10 and 18 (as per the rejections and arguments discussed *supra*), therefore Horst and Wu render these limitations obvious.

Applicant's argument that each dependant claim is allowable for further limiting an allegedly allowable base claim is rendered moot, as Examiner maintains that Horst anticipates and/or renders obvious each of the base claims as per the rejections, *supra*.

Conclusion

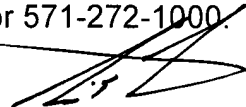
8. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).
9. A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Craig E. Walter whose telephone number is (571) 272-8154. The examiner can normally be reached on 8:30a - 5:00p M-F.

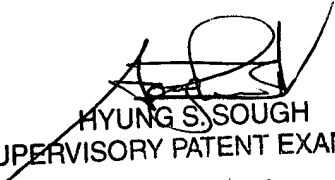
10. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Hyung S. Soug can be reached on (571) 272-6799. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

11. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



Craig E Walter
Examiner
Art Unit 2188

CEW



HYUNG S. SOUGH
SUPERVISORY PATENT EXAMINER

01/25/08